

**AMENDMENTS TO THE DRAWINGS**

The attached sheets include changes to FIG. 2. These sheets, which includes a replacement sheet and annotated sheet of FIG. 2, replace the original sheet including FIG. 2. In FIG. 2, the following previously omitted elements have been included. All added elements to FIG. 2 are supported by the Applicants' specification, claims, or both as originally filed.

<u>Element No.</u>	<u>Element Name</u>	<u>Reference in Spec/Claim</u>
27	Electron Beam Subsystem	Paragraph [0023]
28	Electron Beam Control Element	Paragraph [0023]
29	Instrumentation Subsystem	Paragraph [0023]
38	Vacuum Subsystem	Paragraph [0025]
39	Reserved	
40	Auxiliary Vacuum Pump	Paragraph [0023]
41	Service Panel	Paragraph [0023]
42	User Interface Screen	Paragraph [0023]
43	Electron Beam Positioning Subsystem	Claim 22
44	Positioning Subsystem Control Element	Paragraph [0029]
45	Positioning Subsystem Motor	Paragraph [0029]
46	Wire Feedstock (Supply)	Paragraph [0033]
47	Wire Feed Housing	Claim 37
48	Wire Feed Motor	Paragraph [0033]
49	Wire Feeding Mechanism	Paragraph [0033]
50	Reserved	
51	Wire Feed Control Element	Paragraph [0033]
52	Reserved	
53	Vacuum Control Element	Paragraph [0025]

Attachments: Replacement Sheet  
Annotated Sheet Showing Changes

**REMARKS/ARGUMENT****I. Disposition of Claims**

Claims 1-59 are pending in the application. Claims 1-58 stand rejected. Claim 59 is withdrawn from further consideration by the Examiner as being drawn to a non-elected invention.

**II. Election/Restriction Requirement**

In response to Examiner's reminder in paragraph 4 of the November 30, 2005 Office Action, Applicants affirm the election (without traverse) to prosecute the invention of Group I, Claims 1-58.

**III. Claim Objections**

Claims 23-29, 33-35, and 43 are objected to. In response to the Examiner's objections under 37 CFR 1.75(c), the Applicants have amended these claims to provide adequate structural support in the recitation of operations. Each of the Examiner's objections is specifically discussed below. These amendments were not made to overcome any prior art.

Claim 23. Claim 23 has been amended such that the electron power subsystem is rated at a voltage range from about 100V to about 240V. The Applicants respectfully argue that the electron beam power subsystem provides an adequate structural nexus associated with the recitation of an operational voltage range. Claim 23 has also been amended to change its dependency from Claim 16 to Claim 15, wherein Claim 16 has been cancelled in this paper.

Claim 24. Claim 24 has been amended such that the electron beam power subsystem is rated at about 110V. The argument made for Claim 23 is also applicable for Claim 24.

Claim 25. The Applicants respectfully request that the Examiner reconsider his objection to Claim 25. The Applicants postulate that the inclusion of Claim 25 in the Examiner's objection was a clerical error. Claim 25 has been amended to change its dependency from Claim 16 to Claim 15, wherein Claim 16 has been cancelled in this paper.

Claim 26. Claim 26 has been amended such that the electron beam power subsystem is rated to provide an accelerating voltage up to about 60kV. The Applicants respectfully argue that the electron beam power subsystem provides an adequate structural nexus associated with the recitation of an operational accelerating voltage range. Claim 26 has also been amended to change its dependency from Claim 16 to Claim 15, wherein Claim 16 has been cancelled in this paper.

Claim 27. Claim 27 has been amended such that the electron beam power subsystem is rated to provide an accelerating voltage up to about 15kV. The argument made for Claim 26 is also applicable for Claim 27.

Claim 28. Claim 28 has been amended such that the electron beam power subsystem is rated to provide an accelerating voltage from about 3kW to about 10kW. The argument made for Claim 26 is also applicable for Claim 28. Claim 28 has also been amended to change its dependency from Claim 16 to Claim 15, wherein Claim 16 has been cancelled in this paper.

Claim 29. Claim 29 has been amended such that the electron beam power subsystem is rated to provide an accelerating voltage from about 3kW to about 5kW. The argument made for

Claim 26 is also applicable for Claim 29.

Claim 33. Claim 33 has been amended such that the positioning subsystem control element is rated to control the four axes moveable platform within +/- 0.001 inch for each linear axis of X, Y, and Z and 0.01 degrees for the a-axis of rotation in the X-Y plane. Support for the addition of the "inch" standard of measurement can be found on page 18, paragraph 0030 in the Applicants' specification. The Applicants respectfully argue that the positioning subsystem control element provides an adequate structural nexus associated with the recitation of an operational accuracy range for the moveable platform.

Claims 34 and 35. Claims 34 and 35 have been amended such that the positioning subsystem control element is rated to control the four axes moveable platform within the stated operational range. The Applicants respectfully argue that the positioning subsystem control element provides an adequate structural nexus associated with the recitation of an operational translational speed range for the moveable platform.

Claims 43 and 44. Claim 43 has been amended wherein original Claim 44 has been substituted with Claim 43. Claim 44 has been amended such that the elements of amended Claim 43 are used to create and sustain a pressure from about  $10^{-4}$  torr to about  $10^{-6}$  torr. The Applicants respectfully argue that the elements of amended Claim 43 (e.g., plumbing subsystem, at least one pump, and vacuum control element) provide an adequate structural nexus associated with the recitation of an operational pressure range for the vacuum subsystem.

With the above amendments, the Applicants' respectfully argue that the claims stand in proper dependent form and respectfully request reconsideration of the claim objections.

**IV. Claim Rejection -- 35 USC §103(s): Claims 1-10, 14-18, 20-43, 49-50, and 53-58**

Claims 1-10, 14-18, 20-43, 49-50, and 53-58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sterett (USPN 5,787,965; hereafter referred to as **Sterett**) in view of Marcus (USPN 5,306,447; hereinafter referred to as **Marcus**) in further view of Rabinovich (USPN 5,578,227; hereinafter referred to as **Rabinovich**). Applicants have cancelled claims 1-3, 9-10, 16-18, 22, 31, 38, 41-42, and 54 as well as amended all remaining independent claims (Claims 4, 56-58).

As the USPTO recognizes in MPEP §2142:

The legal concept of *prima facie* obviousness is a procedural tool of examination which applies broadly to all arts. It allocates who has the burden of going forward with production of evidence in each step of the examination process ... The examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness. If the examiner does not produce a *prima facie* case, the applicant is under no obligation to submit evidence of nonobviousness ... The initial evaluation of *prima facie* obviousness thus relieves both the examiner and applicant from evaluating evidence beyond the prior art and the evidence in the specification as filed until the art has been shown to suggest the claimed invention. (emphasis added)

To reject claims of an application under 35 U.S.C. 103(a), an Examiner has the burden of establishing an un rebutted *prima facie* case of obviousness. To establish a *prima facie* case of obviousness, a patent Examiner must show: (1) a suggestion or motivation to modify and/or combine the references, (2) a reasonable expectation of success, and (3) the prior art must teach

or suggest all the limitations of the rejected claim. *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991), *see also*, M.P.E.P. §§2142-3. *See In re Deuel*, 51 F.3d 1552, 1557, 34 U.S.P.Q.2d 1210, 1214 (Fed. Cir. 1995). In the absence of a proper *prima facie* case of obviousness, an applicant who complies with the other statutory requirements is entitled to a patent. *See In re Oetiker*, 977 F.2d 1443, 1445, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992).

“The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art suggests the desirability of the combination.” M.P.E.P. §2143.01 (*citing In re Mills*, 916 F.2d 680, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990)). “The level of skill in the art cannot be relied upon to provide the suggestion to combine references.” M.P.E.P. § 2143.01 (*citing Al-Site Corp. v. VSI Int’l Inc.*, 174 F.3d 1308, 50 U.S.P.Q.2d 1161 (Fed. Cir. 1999)). In other words, the absence of an objective suggestion to combine in the prior art references is dispositive of an obviousness determination. *See Gambro Lundia AB v. Baxter Healthcare Corp.*, 110 F.3d 1573, 1578-79, 42 U.S.P.Q.2d 1378, 1383 (Fed. Cir. 1997).

The Applicants respectfully traverse the rejections as applied to Claims 4-10, 14-18, 20-43, 49-50, and 53-58 and respectfully argue that the Examiner has not established a *prima facie* case of obviousness for the following reasons:

#### IV.A Claim Amendments

The Applicants have amended all remaining independent claims (Claims 4, 56-58) such that a feed subsystem is capable of depositing a feedstock at a target location relative to a position of an object. The Applicants have also amended all independent claims such that an electron beam subsystem is capable of melting a feedstock at the target location in a sequential

manner and sustaining a molten pool at the target location. Support for these amendments is found in the Applicants' specification, page 29, lines 8-14.

IV.B References are not Properly Combinable or Modifiable if the Primary Reference's Intended Function is Destroyed and Proposed Modification Cannot Change the Principal of Operation of the Primary Reference

The combination or modification of the references in the manner suggested by the Examiner would render the primary reference (**Sterett**) inoperable for its intended purpose.

MPEP §2143.01 states:

If [the] proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification.

Also, the combination or modification of the references in the manner suggested by the Examiner would change the principle of operation of the primary reference (**Sterett**). MPEP §2143.01 states:

If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious.

Because from the facts derived from the reference, as set forth below, the suggested combination or modification would render the primary reference inoperable for its intended purpose and would change the principal operation of the primary reference, the rejection is unsupported by the art and should be withdrawn.

**Sterett** forms a three-dimensional article by supplying substantially uniform size metal droplets of a desired material (ref: **Sterett**, Abstract, lines 2-4). **Sterett** explicitly states that his/her invention does not spread a layer of metal powder or metal wire and does not selectively sinter said layer (ref: **Sterett**, Col. 5, lines 46-47). Rather, **Sterett** first melts a supply of metal and then drops said melted metal to a desired location (ref: **Sterett**, Col. 6, lines 10-12; Col. 8, lines 9-11).

Thus, the intended purpose of **Sterett**'s invention is not the general formation of a three-dimensional object, but rather the formation of a three-dimensional object using molten metal droplet deposition. If one replaced the wire feed subsystem of **Rabinovich** with the molten metal droplet deposition subsystem of **Sterett**, **Sterett**'s invention would be inoperable for its intended purpose of molten metal droplet deposition to form a three-dimensional object and would change its principal operation. The Applicants respectfully argue that there is a lack of technical motivation for making the modification of substituting **Sterett**'s molten metal droplet deposition system with **Rabinovich**'s wire feed system. It is not seen by the Applicants that **Sterett** would have provided any motivation to one of ordinary skill in the art to substitute **Rabinovich**'s wire feed system (which requires sintering) with **Sterett**'s molten metal droplet deposition system (which does not require sintering). **Sterett** is very clear that the novelty and essential element of his/her invention is the molten metal droplet deposition system. Replacing a wirefeed system with **Sterett**'s molten metal deposition system would result in a domino effect of requiring a sintering device, wherein no motivation or suggestion for such a sintering device is found in **Sterett**. In fact, as will be argued *infra*, **Sterett** teaches away from a sintering system



(ref: **Sterett**, Col. 5, lines 46-47). Simply stated, it is not seen by the Applicants that **Sterett** would have provided any motivation to one of ordinary skill in the art to substitute **Rabinovich**'s wire feed system (which requires sintering) with **Sterett**'s molten metal droplet deposition system (which does not require sintering and teaches away from sintering).

Therefore, the Applicants traverse the Examiner's rejections and respectfully argue that a *prima facie* case of obviousness has not been established.

#### IV.C Teaching Away

The references teach away from the Examiner's proposed combination. MPEP §2145 states:

It is improper to combine references where the references teach away from their combination.

Because from the facts derived from the references, as set forth below, the references teach away from their combination, the rejection is unsupported and should be withdrawn.

First, as stated *supra*, **Sterett** teaches a molten metal droplet deposition system. The modification proposed by the Examiner combines elements in **Sterett**, **Marcus**, and **Rabinovich** to form a freeform fabrication system using a wire feed means wherein said wire feed means is melted or *sintered* by an electron beam device in layers. **Sterett** argues that there is a need for an improved method for creating three-dimensional or solid objects which utilizes accurate deposition of a material onto a work surface (ref: **Sterett**, Col. 4, lines 3-5). **Sterett** discusses that due to the aforementioned need, a new method for creating a three-dimensional solid object

by depositing a molten metal has now been developed (ref: **Sterett**, Col. 5, lines 12-16). **Sterett** also argues that his/her invention does not involve the use of multiple processing steps to form each layer of deposition (ref: **Sterett**, Col. 5, lines 23-27). Further, **Sterett** emphasizes that no sintering processes are needed to form a three-dimensional object according to his/her invention (ref: **Sterett**, Col. 5, lines 46-48). The Applicants respectfully argue that, in essence, **Sterett** is teaching away from the use of sintering processes and wire feed systems to form three-dimensional articles.

Second, **Marcus** teaches the use of a chamber filled with a gas phase comprising one or more vapor-state gas components (ref: **Marcus**, Col. 2, lines 36-43). An energy beam, preferably a laser, is directed over a target area thereby selectively depositing material from the gas components to produce successive layers. **Marcus** does disclose the use of an electron beam (ref: **Marcus**, Col. 6, line 49). But, **Marcus** discloses an electron beam only one time in his/her entire specification and does not expand on how an electron beam would function in his/her gas phase environment. Simply stated, the use of a chamber filled with a gas phase inherently teaches away from the use of an electron beam in a freeform fabrication apparatus. For an electron beam to function properly in a freeform fabrication apparatus, a vacuum environment is required to ensure minimal loss of energy (i.e., to prevent the dispersion of electrons). Theoretically, an electron beam source can be placed extremely close to a target location in a gas-filled environment. However, such a design would be impractical in a freeform fabrication system wherein the goal is to fabricate actual-size three-dimensional objects. Further, **Marcus'** system teaches away from placing an electron beam source extremely close to a target because

**Marcus** positions an energy beam source external to a chamber. No other embodiments are taught or suggested in **Marcus**. As will be discussed *infra*, the energy beam source passes through a transparent window. If one uses the system of **Marcus**, which requires filling a chamber with a predetermined gas containing a predetermined material at a predetermined vapor pressure (i.e., definitely not a vacuum environment), an electron beam, emitted from a source positioned external to a chamber would quickly disperse and would lose most of its intensity when the electrons in the beam interact with the surrounding gas molecules to the point that it is incapable of melting metal. (ref: "Chapter 21: Electron Beam Welding;" O'Brien, R. L., editor; Welding Handbook, 8th Edition, Volume 2; American Welding Society, Miami, FL, (1991); pp. 676-678) Simply stated, in a gas-filled environment, it is impractical to use an electron beam energy source for **Marcus**' purposes. Thus, although **Marcus** discloses an electron beam, **Marcus** inherently teaches away from the use of an electron beam in his/her invention.

Third, **Marcus** teaches the use of an energy beam source passing through a "beam transparent" window through which energy beams may pass (ref: **Marcus**, Col. 10, lines 21-23). **Marcus** then immediately starts to focus on a laser beam (ref: **Marcus**, Col. 10, lines 23-25). **Marcus** does not provide any detail relative to how an electron beam can pass through a "beam transparent" window. Further, **Marcus** does not expand on what he/she means by the term "beam transparent" other than a window in which beams may pass. It is commonly known that photons from a laser can be transmitted through a glass window. However, it is also commonly known that electrons require an unobstructed path between the filament of an electron beam gun and a target. Moreover, passing an electron beam through a window requires further explanation

and description, something **Marcus** does not do. Instead, the description lacks a technical explanation relative to how an electron beam can pass through a transparent window and effectively operate in a gas-filled environment, because the specification merely adds the use of an electron beam in a laundry list of presumably equivalent energy beam sources. Based on the lack of description surrounding **Marcus**' use of an electron beam, it becomes rather obvious to the reader that **Marcus** includes the use of an electron beam as a technical "filler" with no substantive technical basis on how to make or use an electron beam source in his/her invention. Thus, the Applicants respectfully argue that **Marcus** inherently teaches away from using a electron beam because he/she a) does not disclose an embodiment wherein the energy device is placed within a chamber, b) only discloses the use of a "beam transparent" window through which an energy beam may pass, and c) does not provide a technical explanation on how an electron beam passes through a window.

Therefore, the Applicants traverse the Examiner's rejections and respectfully argue that a *prima facie* case of obviousness has not been established.

#### IV.D All Claim Limitations Must Be Considered

The references do not teach or suggest all the claim limitations *as amended*. When evaluating a claim for determining obviousness, all limitations of the claim must be evaluated.

MPEP §2143.03 states:

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art.

Because from the facts derived from the references, as set forth below, the references do not teach or suggest all of the claim limitations, and thus, the rejection is unsupported by the art and should be withdrawn.

As stated in Section IV.A of this paper, the Applicants have amended all independent claims such that an electron beam subsystem is capable of melting a feedstock at a target location in a sequential manner and sustaining a molten pool at the target location.

**Sterett** does disclose melting a metal deposition material and sustaining a molten pool. However, **Sterett**'s deposition system is designed around *first* melting a metal and depositing metal droplets to a target location. **Sterett** also discloses an elaborate system of subjecting each metal droplet to alternative positive and negative charges. **Sterett** does not teach or suggest melting a feedstock at a target location relative to a position on a fabricated object in a sequential manner and sustaining a molten pool at the target location.

**Marcus** does disclose systems that sinter metal powder (ref: **Marcus**, Col. 2, lines 27-33), but does not teach or suggest melting a feedstock at a target location in a sequential manner and sustaining a molten pool at the target location.

**Rabinovich** does disclose "continuous welding" (ref: **Rabinovich**, Col. 3, lines 61-65), however, **Rabinovich** does not sustain a molten pool at a target location. Specifically, **Rabinovich** states, " ... welding of the feedstock to a previous fused layer while keeping the *feedstock cross section in substantially the same shape.*" (emphasis added) (ref: **Rabinovich**, Col. 3, lines 63-65) It is clear from this statement that the feedstock material is not wholly

incorporated into the melt pool, but rather, the feedstock material is simply being welded to a substrate or a previous layer.

Therefore, the Applicants respectfully traverse the Examiner's rejections relative to the claims *as amended*, respectfully argue that a *prima facie* case of obviousness has not been established relative to the amended claims, and respectfully request reconsideration of the rejections in light of the claim amendments.

**V. Claim Rejection -- 35 USC §103(a): Claims 11-13, 19, 44-48**

Claims 11-13, 19, 44-48 stand rejected under 35 USC §103(a) as being unpatentable over **Sterett** in view of **Marcus** in further view of **Rabinovich** and in further view of Jang (USPN 6,180,049; hereinafter referred to as **Jang**). Applicants have cancelled claims 45-46.

With respect to claims 11-13, 17, 44, 47 and 48, the arguments made in Section IV of this paper are herein incorporated by reference. The Applicants have respectfully argued that the Examiner has failed to establish a *prima facie* case of obviousness for combining **Sterett** in view of **Marcus** in further view of **Rabinovich**. Thus, because the addition of **Jang** is dependent on the **Sterett/Marcus/Rabinovich** combination, the **Sterett/Marcus/Rabinovich/Jang** combination also fails to establish a *prima facie* case of obviousness.

Therefore, the Applicants traverse the Examiner's rejections of Claims 11-13, 19, 44, 47-48 and respectfully argue that a *prima facie* case of obviousness has not been established.

**VI. Claim Rejection -- 35 USC §103(a): Claims 51-52**

Claims 51-52 stand rejected under 35 USC §103(a) as being unpatentable over **Sterett** in view of **Marcus** in further view of **Rabinovich** and in further view of **Jang** and in further view of Langer (USPN 5,460,758; hereinafter referred to as **Langer**). Claims 51-52 have been cancelled in this paper.

## **VII. Miscellaneous Claim Amendments**

Claim 15. Claim 15 was amended to delete references to deflection and focusing coils. This amendment was not made to overcome any prior art.

Claims 19-21. Claims 19-21 have been amended to change its dependency from Claim 16 to Claim 15, wherein Claim 16 as been cancelled in this paper. This amendment is clerical in nature and was not made to overcome any prior art.

Claim 47. Claim 47 has been amended to change its dependency from Claim 44 to Claim 43. This amendment is clerical in nature and was not made to overcome any prior art.

Claim 50. Claim 50 has been amended to remove the “means for lighting electronically connected to said visual monitoring means for monitoring the fabrication process” element. This amendment was not made to overcome any prior art.

## **VIII. Amendments to the Specification**

Paragraphs [0023], [0025], [0029], and [0033] have been amended to include several element reference numbers wherein these reference numbers are commensurate with the proposed amendments in FIG. 2. No new matter has been added.

Further, paragraph [0033] was amended to include “a wire feed housing 47 contained within the sealed container 10 and capable of accommodating the wire feed supply.” Said amendment is supported by Claim 37 as originally filed.

Still further, paragraph [0033], first sentence, was amended to replace “that consists” with “comprised.” This amendment is supported by Claim 37 as originally filed.

#### **X. Amendments to the Drawings**

FIG. 2 has been amended to comply with 37 CFR 1.83(a) (ref: MPEP 608:02(d)). Additions have been limited to labeled box representations and hence, no new matter has been added. All elements added in FIG. 2 were disclosed in the Applicants' specification, claims, or both as originally filed. The USPTO's acceptance of the drawing amendment is earnestly solicited.



**XI. Conclusion**

In summary, Applicants now therefore respectfully submit that the application presently stands in condition for allowance.

Respectfully submitted,

Date: 2/22/06

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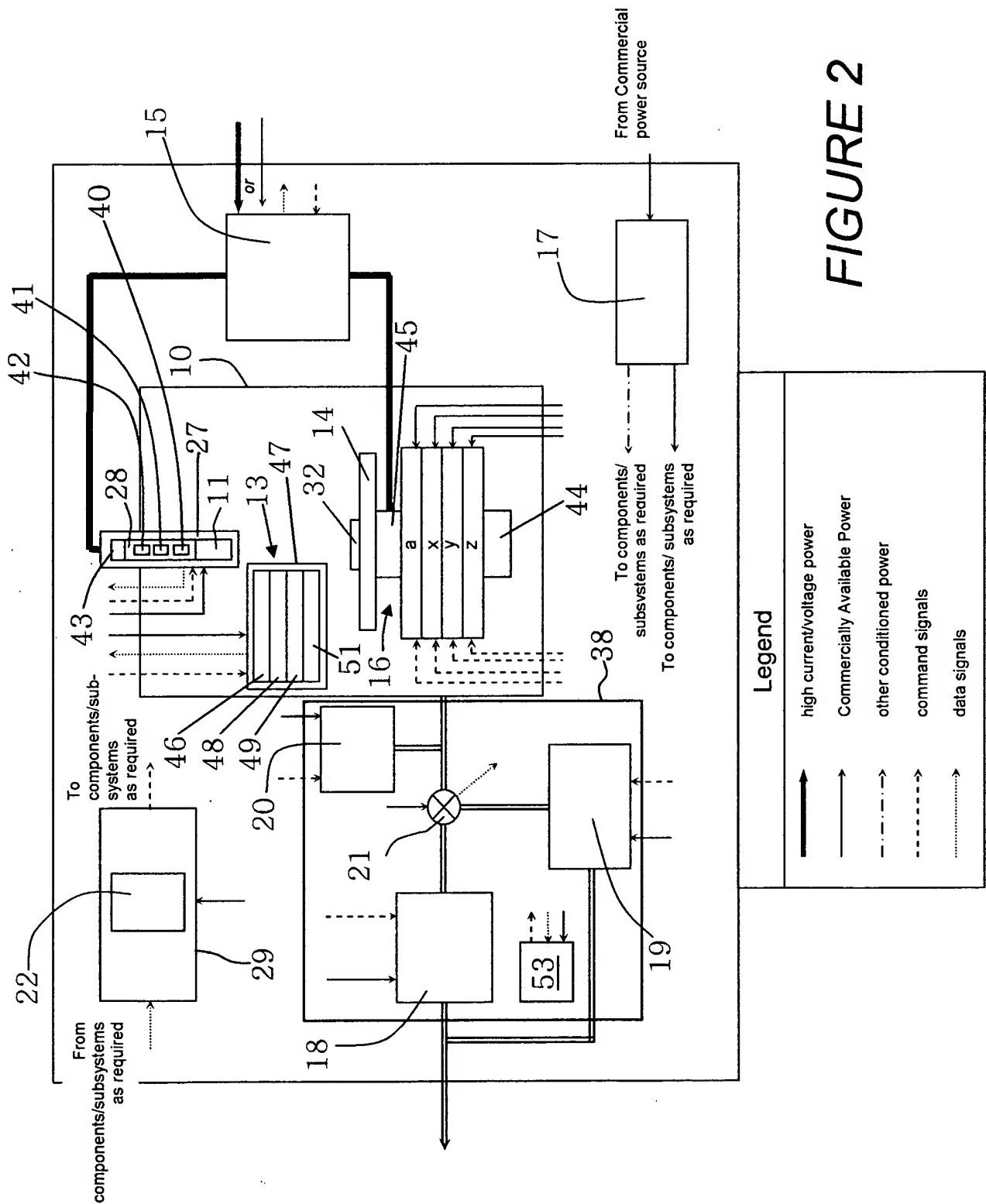


FIGURE 2